An Augmented Reality Application for Studying the Lives of Animals

Yulia, Liliana, Robert Hartono

Petra Christian University
Siwalankerto 121-131
Surabaya, East Java, Indonesia
yulia@petra.ac.id

Abstract

Augmented reality is an interaction tool for human and machine that integrates the digital information with the user's environment in real time, uses the existing environment and overlays new information on top of it. This paper discusses the development process of an interactive augmented reality for children in learning about the lives of animals. Children can see the lives of animals in real three-dimensional form. The main objective of this study is to aid students and it could potentially enhance their learning process about the lives of animals. The study found that children's perception of the use of augmented reality is positive based on the average score was quite good.

Keywords-augmented reality, the lives of animals, learning process

I. Introduction

Nowadays, the way of learning is changing, technologies give the opportunity for children to communicate and interact with multimedia learning resources and artificial simulated environments. Adding the technology can help children to acquire information whenever they need it. With advances in technology, it can stimulate the learning environment and encourage children motivation. These are important factors in a learning process [1].

This research uses a technology called Augmented Reality (AR). Unlike Virtual Reality (VR) that works by disconnecting real-world contacts and creating a new world virtually, AR actually enriches the real world with virtual or imaginary content. In general, AR is the process of adding virtual content to the real world, so users can interact with virtual content directly in the real world. It can be viewed using some devices like computer or mobile device equipped with at least one back camera and a see-through Head Mounted Display (HMD).

In this research, AR technology is presented using a mobile device as assistive learning tool to provide flexibility for children to learn without being limited by time and place. Children will learn about the lives and behaviors of animals.

There are two conditions associated with learning: location and time [1]. Based on these, there are some problems in learning. Currently parents do not have enough time to take their children to the zoo to learn about the lives of animals. Whereas children will be easier to understand by seeing directly. However, these problems could be solved by introducing alternative learning resources such as mobile learning tools. Children can learn about the lives of animals by seeing directly anytime and anywhere.

The proposed approach is designed for children to gain his knowledge about the lives of animals. It offers the possibility to interact in a more active and attractive way with the technology and the contents to be learnt, by changing his perception of the real environment

II. Concept

AR covers a variety of areas which it can be used to provide innovative solutions or approaches to real-world problems. In the related literature, it has been shown that AR can be applied for different tasks – problems in the modern life [2–6]. Augmented reality (AR) refers to a broad spectrum of technologies that project computer-generated materials, such as text, images, and video, to the user's perception of the real world [7]. Ludwig and Reimann (2005) define AR as "human-computer-interaction, which adds virtual objects to real senses that are provided by a video camera in real time" [8].

AR can provide a variety of important information and users can use all of their senses in using AR, so that users can more easily in learning and training [9-11]. AR itself includes the level of semi-immersive / mix reality [12] (Fig. 1).

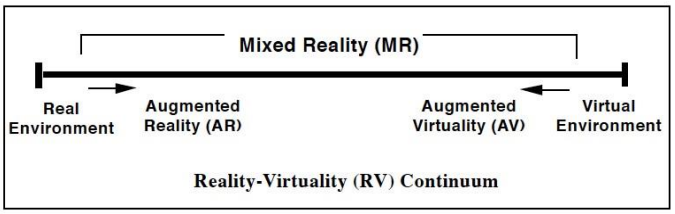

Fig. 1 Mixed Reality [13]

The purpose of AR is to enable users to interact with virtual and real environment in real time. The user will really feel the virtual world in real terms. AR has three important aspects: first, AR is not limited to particular display technologies such as HMD. Second, AR is not only through sight but it can be through hearing, touch, even smell. Third, AR eliminates real objects with virtual objects [4].

There are two tracking device ability: marker tracking and markerless tracking. In the marker tracking, there is an object /

image that is set to be the position of the 3D object exit. The objects / images used are referred to as trackable. In markerless tracking systems have been programmed to detect some colors or objects with predefined shapes. For example, the system has been set to detect a green object, and change the color of the sphere to blue. In this case the system is only trying to find a green object, if it has been found it will display a blue visual object. Systems can also be trained to recognize faces [14]. Fig. 2 is a sample marker and Fig. 3 is a sample of markerless.

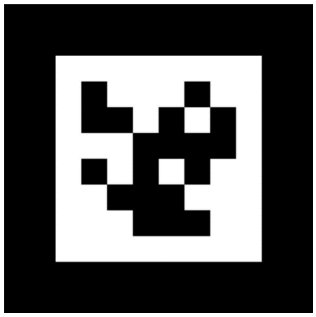

Fig. 2 Marker Example [15]

Fig. 3 Markerless Example [16]

III. Development Phases

This study is restricted to some animal species including wolves, elephants, rhino, zebra, lion, rabbit, deer, wolf, crocodile and fox. And in this paper, the discussion is restricted on the lives of lions. If the lion marker is detected, then the lion's object will appear with Hit Point (HP) 100. At the beginning of this application, the lion will be in small size, in every 15 seconds the lion will grow and the age of the lion will be increased. The lion will perform a state roar at the time the marker is detected and in every 15 seconds will alternate with the walk state. If there is a zebra in savannah then a lion's bandwagon will appear, and the lion will perform a food state chase that the lion will run towards the zebra object position, and when the male lion is right in the zebra position, the lioness will attack the zebra, if HP zebra has reached 0, lion will enter into eat state. If a lion goes into a hungry status, then the lions will decrease slowly every 5 seconds, and the lion has to be fed with a zebra object scan. If there is an interaction with the bear object, then this application will check on the of the male lion. If the lion is not yet 2 years old then the lion will go into the run state, and if the lion is caught by the bear then the lion will go into the get hit state. Conversely, if the lion has reached the age of 2 years and above, the lion will enter into the enemy state chase, and if the lion and the bear adjacent then the lion will go into the attack enemy state. There are several conditions in which the lion is in the die state. First when the lion time has appeared on the application for 3 minutes. Secondly when HP lion reaches 0. If the lion is dead, the lion can live again by keeping the marker out of camera's reach and detecting the lion marker again. Fig. 4 is a finite state machine of the lives of lions

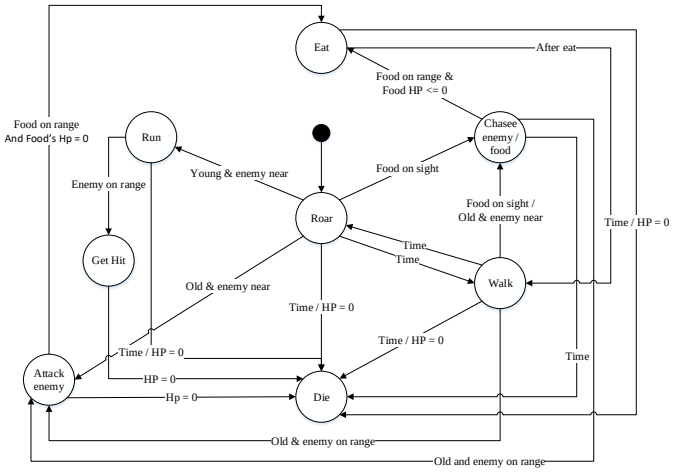

Fig. 4 Finite State Machine of the lives of lions [17].

IV. Testing and Evaluation

A. Finie State Machine Testing

This study used Visual Studio C##, Unity, and Adobe Illustrator to develop the learning system and content. The interface of the learning system was presented as a book

Fig. 5 Marker and Lion

containing some animal picture. The marker and the object are displayed in Fig. 5.

Fig 6. Lion on state walk

In Fig. 6, the lion performs a state walk and will alternate with the state roar if there is no interaction between the other

animals.

Fig 7. Lion on state roar

In Fig. 7 the lion performs a state roar at the time the marker is detected and in every 15 seconds, the male lion will perform a state roar for a few seconds.

Fig 8. Lion on state chase food

In Fig. 8 lion enters into state chase food when zebra is in the savanna.

Fig 9. Lion on state eat

In Fig. 9 the lion goes into state eat when zebra is dead or zebra hit point is less or equal to zero

Fig 10. Lion on state run

In Fig. 10 lions enter the state run when there is a bear in the savanna and the male lion is still not in the adult stage. Male lions enter the adult stage at the age of 4 years. When a lion is caught or a bear has been very close to the lion, the bear will attack the male lion.

Fig 11. Lion on state gethit

In Fig. 11 the lion enters into the gethit state when caught by a bear, and the lion still has not entered the adult stage.

Fig 12. Lion on state chase enemy

In Fig. 12 the lion goes into the state chase enemy when in the savanna there is bear and the lion is in the adult stage.

Fig 13. Lion state attack enemy

In Fig. 13 the lion performs state attack enemy when the lion is in the adult stage and when the bear and the lion are close together. Lions and bears will attack each other.

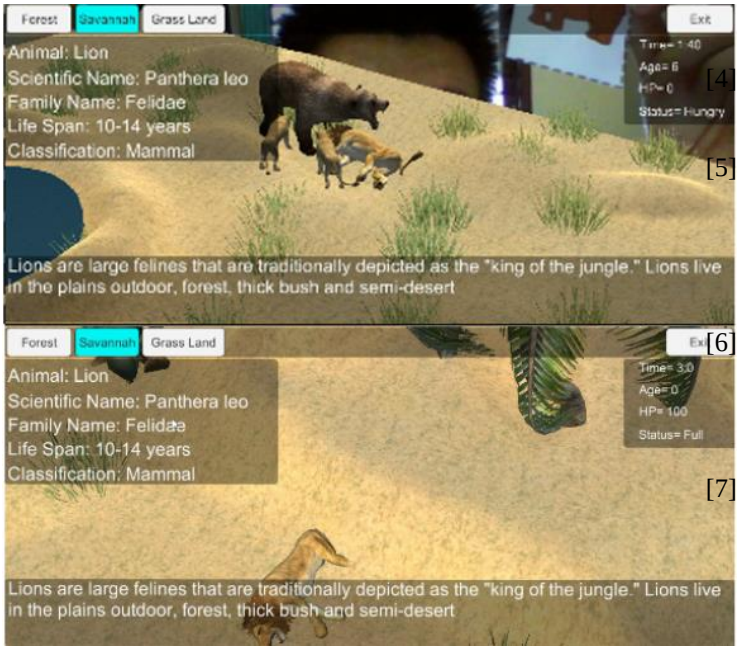

Fig. 14. Lion on state dead

In Fig. 14 lion enter into the dead state when the lion has a Hit Point that is less or equal to zero and when the lion has appeared in the application for 3 minutes.

B. Evaluation of Interface, Ease of Use and Usability

About twenty children participated in the pilot tests to evaluate the interface and functions of the application. For each pilot test, the researcher asked children to fill out a questionnaire and discussed with them regarding their responses. The children gave positive feedback about the application. 80% said that the application is good. 70% said that the application is easy to use. 80% said that they are happy to use this application

V. Conclusion

This paper presented the development of a mobile AR for children in learning the lives of animals. Importance of the study is associated with research efforts performed to evaluate the effectiveness of AR on improving children learning experiences. Based on observational study, the children are considerably interested in the application. Regarding to the future work, it has been planned to improve the application by adding new states and functions.

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